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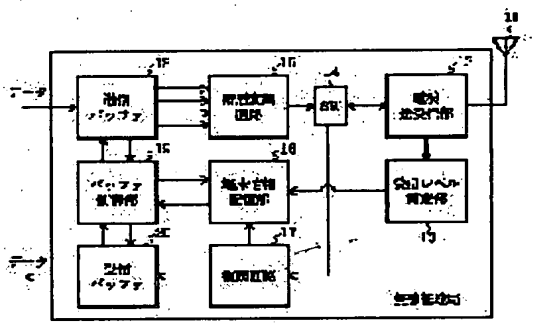
(54) RADIO TRANSMISSION DEVICE AND RADIO COMMUNICATION EQUIPMENT

(57)Abstract:
PROBLEM TO BE SOLVED: To simultaneously transmit data to a plurality of terminals with one slot and to improve transmission efficiency by hierarchizing data and hierarchy-multiplexing/transmitting data through the use of a hierarchy modulation system when data is transmitted to a plurality of radio terminals from the radio base station by a TDMA system.
SOLUTION: Whenever a radio transmission/reception part 12 receives a signal from a radio terminal, a reception level measurement part 13 measures a signal level and stores it in a terminal information storage part 16 with transmission source terminal information taken in a demodulation circuit 17. On the other hand, transmission data to the radio terminal is once accumulated in a transmission buffer 18 and a buffer control part 19 decides the hierarchizing of output data based on terminal information of the terminal information storage part 16. Transmission data is sent from the transmission buffer 18 to a hierarchy modulation circuit 15. Resistance against noise is improved by allocating data to the hierarchy of the signal of high quality in order from the smallest reception level. Hierarchy is modulated and the radio transmission/reception part 12 transmits data as a transmission frequency. Thus, transmission success probability is improved and transmission efficiency is improved.



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CLAIMS

[Claim(s)]
[Claim 1] The wireless sending set characterized by to include the means which the circuit from which two or more kinds of communication link quality differs is set to said modulation means in the wireless sending set equipped with the modulation means which carries out multiplex modulation of the information on N circuit that two or more communication link information according to individual to the destination terminal of N is transmitted at coincidence at one subcarrier, and assigns a circuit according to the required communication link quality for every destination terminal.
[Claim 2] Said required communication link quality is the wireless sending set [equipped with a means for it to be set up according to the distance of said destination terminal and a self-wireless sending set, and to detect the received signal level from said destination terminal, and a means to presume the distance of said distance according to the received signal level detected by this means to detect] according to claim 1.
[Claim 3] Said required communication link quality is a wireless sending set according to claim 1 set up according to a demand of said destination terminal.
[Claim 4] Said modulation means is the wireless sending set according to claim 1 with which the circuit from which said communication link quality differs was set up by arranging the distance between the ****** signal points on IQ flat surface to an ununiformity, and preparing a difference in the discernment quality in the receiving side including a multiple-value QAM modulation means.
[Claim 5] For arrangement of the signal point on said IQ flat surface, said multiple-value QAM modulation means is a wireless sending set including the means which assigns the bit for distinguishing a signal point for the bit for the distance d1 between signals between the quadrants on said flat surface being set up more greatly than the distance d2 between signals in the quadrant, and identifying a quadrant within allocation and a quadrant in the high circuit of communication link quality to the low circuit of communication link quality according to claim 4.
[Claim 6] Said multiple-value QAM modulation means is a wireless sending set according to claim 5 which is a 16QAM modulation means.
[Claim 7] The radio communication equipment characterized by having had one base transceiver station and two or more wireless terminals which communicate to mutual [this / base transceiver station and mutual], and equipping said base transceiver station with a wireless sending set according to claim 1, the wireless receiving set which receives the signal from said

wireless terminal, and a means to perform automatically circuit allocation according to communication link quality according to the signal quality from said two or more wireless terminals received by this wireless receiving set.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention is used for the radio performed between one base transceiver station and two or more terminals. This invention is wireless LAN (Local Area Network) used in short distances, such as inside of one the interior of a room or one building. Although it is the technique developed at the sake, it can use widely besides this. This invention relates to the technique of preparing the grade (hierarchy) of communication link quality in one subcarrier especially at two or more of the circuits by which multiplex modulation is carried out about the multiplex modulation which modulates to coincidence the information on the multiple-line addressed to two or more terminals. It expresses learning becoming irregular in different quality according to an informational significance from expressing in the field of an image processing technique, saying "It hierarchizes and becomes irregular", preparing grade (hierarchy) in the communication link quality of two or more circuits on these specifications, and carrying out multiplex modulation to one subcarrier as a "hierarchy modulation."
[0002]
[Description of the Prior Art] Conventionally, there is wireless LAN as one of the systems which communicate between two or more wireless terminals and one base transceiver station. In this wireless LAN system, in order to communicate by sharing the existing regular communication line which was assigned to one base transceiver station for the communication link of two or more wireless terminals, that communication line was divided by the frequency or time amount, and the approach of communicating by assigning it to the communication link between one wireless terminal is taken. At this time, the approach the method of dividing a frequency divides a frequency multi-access (FDMA) and time amount is called time multipled access (TDMA).
[0003] In the above systems, there is the approach (it is called a reservation method) of assigning a communication line to each transmission place wireless terminal, whenever it does not assign the communication line divided by the frequency or time amount to each wireless terminal fixed but the data to transmit are generated, in order to raise the utilization ratio of a communication line. Thereby, one base transceiver station can be efficiently performed using the band to which the communication link with more wireless terminals was restricted.
[0004] When it considers as a TDMA method and considers as the reservation method explained above, an example of a transmission frame which transmits data between a base transceiver station and each wireless terminal is shown in drawing 8 . A reservation slot is used in order to reserve the communication line which a wireless terminal uses to a base transceiver station, or in order to report the communication line which a base transceiver station uses to a wireless

terminal. An authorization slot is used in order that a base transceiver station may permit transmission to a wireless terminal. A data slot is used in order to transmit data. A check slot is used to a base transceiver station and a wireless terminal for the check of whether transmission of data was performed correctly. In order to carry out multiplex in time, each slot of reservation, authorization, data, and a check is further divided into some two or more mini slots, as shown in the data mini slot of drawing 8 .

[0005] When transmitting a data packet to a wireless terminal from a base transceiver station, in advance of transmission of data, a base transceiver station reports the wireless terminal which serves as the transmitting destination using a reservation slot. Then, a base transceiver station transmits the data packet of each addressing to a wireless terminal in order using the data mini slot divided by time amount. And if the wireless terminal to which data transmission is reported previously receives the data packet transmitted from a base transceiver station by the reported data mini slot and this is received correctly, it will be transmitted by the check mini slot corresponding to the data slot which received the acknowledge signal.

[0006]

[Problem(s) to be Solved by the Invention] In recent years, in the wireless packet communication system represented by the wireless LAN system, the increment in the number of wireless terminals in which one base transceiver station and communication link are possible, improvement in transmission efficiency, and increase of transmission capacity are desired with the spread of computers, and the increment in multimedia communication.

[0007] as mentioned above, the data packet which can be transmitted by one slot so that the configuration of the transmission frame of drawing 8 may show since the communication line divided by time amount is shared and used at two or more terminals in a TDMA method — at most — it is a piece and cannot transmit to two or more wireless terminals by one slot at coincidence. For this reason, if the number of the wireless terminals which communicate with one base transceiver station increases, since the number of the data packets which wait for transmission to a base transceiver station will increase, a transit delay causes deterioration of the transmission quality, such as becoming large, and also becomes causing decline in transmission efficiency by the collision of a packet etc. Furthermore, the problem that the capacity of the buffer which accumulates the waiting data packet for transmission in the base transceiver station must be increased is also produced.

[0008] This invention aims at offering the wireless sending set and radio communication equipment which make it possible to transmit data at coincidence to two or more wireless terminals, when it is carried out to such a background and transmits data to two or more wireless terminals by the TDMA method from one base transceiver station. This invention aims at offering the wireless sending set and radio communication equipment which can aim at improvement in transmission efficiency, and increase of transmission capacity. This invention aims at offering the wireless sending set and radio communication equipment which can raise the transmitting success probability of transmit data. This invention aims at offering the wireless sending set and radio communication equipment which can raise signal-transmission quality. This invention aims at offering the wireless sending set and radio communication equipment which can make small capacity of the transmission buffer of the base transceiver station which stores the waiting data for transmission. This invention aims at offering the wireless sending set and radio communication equipment to which the number of the wireless terminals in which one base transceiver station and communication link are possible can be made to increase.

[0009]

[Means for Solving the Problem] This invention carries out hierarchy multiplex [of the data of two or more addressing to a wireless terminal] by using a hierarchy modulation technique by the signal by which quality differs by carrying out allocation hierarchization in the bit from which a modulation symbol differs, although the data of two or more addressing to a wireless terminal are transmitted from a base transceiver station, and it is transmitted to it. Thereby, a base transceiver station can be transmitted to two or more wireless terminals by one slot at coincidence. Moreover, in case a base transceiver station hierarchizes the data of two or more addressing to a wireless terminal, it is assigned and transmitted to the hierarchy of the high

signal of quality from the wireless terminal measured beforehand based on the receiving level of the signal transmitted to the last sequentially from the data of addressing to a wireless terminal with small receiving level.

[0010] Generally, the wireless terminal with a small received signal level is located in a point distant from a base transceiver station, and a large wireless terminal is located in the point near a base transceiver station. Receiving level is small, and it is assigned to the signal of high quality, and since resistance over a noise is made high and it is transmitted, even if the data to the wireless terminal generally located in a point distant from a base transceiver station have the somewhat crude transmission line of the wireless terminal and base transceiver station, they can make the transmitting success probability high.

[0011] Moreover, since receiving level is large and the data to the wireless terminal generally located near the base transceiver station have the comparatively good transmission line between the wireless terminal and base transceiver station, even if it assigns and transmits to the signal of to some extent low quality, the transmitting success probability does not fall.

[0012] The transmitting success probability of the data transmitted from a base transceiver station improves by this, it does not come out of the capacity of the buffer of the base transceiver station which stores the waiting data for transmission as much as possible small, and the transit delay of data can be made small, and transmission efficiency can be improved.

[0013] Moreover, when it has the communication link quality demanded for every wireless terminal, since the transmission quality is assigned in order of the height of the demand quality, the transmitting success probability of data improves, similarly it does not come out of the capacity of the buffer of the base transceiver station which stores the waiting data for transmission as much as possible small, and the transit delay of data can be made small, and transmission efficiency can be improved.

[0014] That is, the first viewpoint of this invention is a wireless sending set, and is the wireless sending set equipped with the modulation means which carries out multiplex modulation of the information on N circuit that two or more communication link information according to individual to the destination terminal of N is transmitted at coincidence at one subcarrier.

[0015] Here, the circuit from which two or more kinds of communication link quality differs is set to said modulation means, and the place by which it is characterized [of this invention] is located in a place including the means which assigns a circuit according to the required communication link quality for every destination terminal.

[0016] Said required communication link quality is set up according to the distance of said destination terminal and a self-wireless sending set, and it is desirable at this time to have a means to detect the received signal level from said destination terminal, and a means to presume the distance of said distance according to the received signal level detected by this means to detect.

[0017] That is, since it is expected that the received signal level in a destination terminal becomes small, and C/N (carrier-to-noise ratio) becomes small about a destination terminal with a far distance from a self-wireless sending set, it is required in order that assigning the circuit of good communication link quality may raise a transmitting success probability. On the other hand, since it is expected that the received signal level in a destination terminal is large, and C/N is also large about a destination terminal with a near distance from a self-wireless sending set, even if communication link quality assigns a comparatively crude circuit, a transmitting success probability does not fall. Therefore, it is good to presume the distance of a self-wireless sending set and a destination terminal, and to assign the circuit of required communication link quality with the received signal level from a destination terminal, according to this.

[0018] Moreover, said required communication link quality may be made to be set up according to a demand of said destination terminal. That is, since respectively required communication link quality differs according to the kind of data which a destination terminal treats as it was called voice, an image, and data, this is grasped in a wireless sending set side, and you may make it assign the circuit of required communication link quality according to this.

[0019] Said modulation means can set up the circuit from which said communication link quality differs by arranging the distance between the ****** signal points on IQ flat surface to an

ununiformity, and preparing a difference in the discernment quality in the receiving side including a multiple-value QAM modulation means.
[0020] It is desirable to include a means to by_which said multiple-value QAM modulation means assigns the bit for distinguishing a signal point for the bit for the distance d1 between signals between the quadrants on said flat surface being larger than the distance d2 between signals in the quadrant, and arrangement of the signal point on said IQ flat surface being set up, and identifying a quadrant within allocation and a quadrant in the high circuit of communication link quality to the low circuit of communication link quality. Said multiple-value QAM modulation means can be a 16QAM modulation means. Thereby, in a receiving side, discernment from the high circuit of communication link quality and the low circuit of communication link quality can be performed easily.
[0021] The second viewpoint of this invention is a radio communication equipment, and it has one base transceiver station and two or more wireless terminals which communicate to mutual [this / base transceiver station and mutual]. In said base transceiver station It is characterized by having the wireless sending set of this invention, the wireless receiving set which receives the signal from said wireless terminal, and a means to perform automatically circuit allocation according to communication link quality according to the signal quality from said two or more wireless terminals received by this wireless receiving set.
[0022] Thereby, when transmitting data to two or more wireless terminals by the TDMA method from one base transceiver station, it makes it possible to transmit data to two or more wireless terminals at coincidence. Therefore, improvement in transmission efficiency and increase of transmission capacity can be aimed at. Moreover, the transmitting success probability of transmit data can be raised. Thereby, signal-transmission quality can be raised. Furthermore, capacity of the transmission buffer of the base transceiver station which stores the waiting data for transmission can be made small. Moreover, the number of the wireless terminals in which one base transceiver station and communication link are possible can be made to increase.
[0023] The third viewpoint of this invention is the hierarchy modulation approach which carries out multiplex modulation of the information according to individual addressed to two or more terminals to the circuit from which communication link quality differs logically at coincidence at the subcarrier of one allocation.
[0024]
[Embodiment of the Invention] The gestalt of implementation of invention is explained with reference to drawing 1 and drawing 2 . Drawing 1 is the important section block block diagram of the base transceiver station of this invention example. Drawing 2 is drawing showing signal point arrangement of hierarchy 16QAM.
[0025] In this invention example, the wireless sending set of this invention is applied to a base transceiver station. That is, as shown in drawing 1 , this invention is a base transceiver station and is the base transceiver station equipped with the hierarchy modulation circuit 15 which is the modulation means which carries out multiplex modulation of the information on N circuit that two or more communication link information according to individual to the destination wireless terminal of N is transmitted at coincidence at one subcarrier.
[0026] Here, the circuit from which two or more kinds of communication link quality differs is set to the hierarchy modulation circuit 15, and the place by which it is characterized [of this invention] is located in the place containing the receiving level test section 13 which is the means which assigns a circuit according to the required communication link quality for every destination wireless terminal, the terminal information storage section 16, and the buffer control section 19.
[0027] Said required communication link quality is set up according to the distance of said destination wireless terminal and self-base transceiver station, it has the receiving level test section 13 which is a means to detect the received signal level from said destination wireless terminal, and the terminal information storage section 16 presumes the distance of said distance according to the received signal level detected by the receiving level test section 13. Or said required communication link quality is set up according to a demand of said destination wireless terminal.

[0028] At this time, the buffer control section 19 performs automatically circuit allocation according to communication link quality according to the signal quality from two or more terminals.
[0029] The circuit from which said communication link quality differs is set up by the hierarchy modulation circuit's 15 performing a multiple-value QAM modulation, arranging the distance between the ****** signal points on IQ flat surface to an ununiformity, and preparing a difference in the discernment quality in the receiving side.
[0030] As shown in drawing 2 , the distance d1 between signals between the quadrants on said flat surface is set up more greatly than the distance d2 between signals in the quadrant, and arrangement of the signal point on said IQ flat surface assigns the bit for distinguishing a signal point for the bit for identifying a quadrant within allocation and a quadrant in the high circuit of communication link quality to the low circuit of communication link quality. Moreover, said multiple-value QAM modulation is a 16QAM modulation.
[0031]
[Example] this invention example is explained. Drawing 3 is drawing showing the example of a configuration of the transmission frame used in order to transmit data between the base transceiver station of this invention example, and a wireless terminal. This example corresponds to the transmission frame in the TDMA method of the conventional technique shown in drawing 8 explained previously, and shows the example which can be transmitted to two wireless terminals from a base transceiver station at coincidence. Hierarchy multiplex [of the data of two addressing to a wireless terminal] is carried out to two signals, a high quality channel and a low quality channel, with which the quality realized by the hierarchy modulation technique differs, and they are transmitted to coincidence.
[0032] It is decided with the number of hierarchies of the hierarchy modulation technique to apply that the number of wireless terminals which can be transmitted will be coincidence. When considering as the multiplex number more than the number of hierarchies of a hierarchy modulation technique, it considers as the slot configuration divided in time like the conventional TDMA method as shown in drawing 3 . Here, by the hierarchy, by dividing into two, a data slot is divided still in time and considered as a total of four slot configurations by dividing into two.
[0033] Next, a hierarchy modulation technique is explained. A hierarchy modulation technique is a modulation technique which hierarchy multiplex [of the signal with which the transmission qualities differ] is carried out, and can transmit it. Drawing 4 is drawing showing signal point arrangement of hierarchy 16QAM which is the example, and four digits of drawing 4 show the 4-bit sign assigned to each signal point. 2 bits of high orders of several characters each support the quadrant in which each signal point is located, and 2 bits of low order support the location of the signal point in each quadrant.
[0034] The resistance over a noise is so high that the distance between signal points is generally large. Therefore, although the distance between each sign is large, the resistance over a noise is high and transmission with low [C/N] is possible about 2 bits of high orders, about 2 bits of low order, the distance between each sign is small and high C/N is required compared with 2 bits of high orders. Then, a hierarchy modulation with two hierarchies is attained by assigning the information by the side of a high quality channel to 2 bits of high orders, and assigning the information by the side of a low quality channel to 2 bits of low order.
[0035] As mentioned above, a hierarchy modulation technique is a modulation technique which makes it possible to carry out hierarchy multiplex [of the signal from which the noise-proof nature differs and the transmission quality differs by this by which bit information is assigned], and to transmit it. In addition, it can have the three or more numbers of hierarchies by devising an approach assigning signal point arrangement and a bit.
[0036] The electric-wave transceiver section 12 which receives the signal with which the wireless terminal transmitted the base transceiver station as shown in drawing 1 , The receiving level test section 13 which measures the receiving level of the signal which the electric-wave transceiver section 12 received, The demodulator circuit 17 which recovers transmitting agency terminal information and data from the signal which the electric-wave transceiver section 12 received, The terminal information storage section 16 which memorizes the receiving level of a

signal including the transmitting agency terminal information to which the demodulator circuit 17 restored, and the transmit-terminal information which the receiving level test section 13 measured, The buffer control section 19 which determines the transmission quality of the addressing transmit data to a wireless terminal based on the information on the terminal information storage section 16, The transmission buffer 18 which hierarchizes transmit data with the transmission quality which carried out the temporary storage of the addressing transmit data to a wireless terminal, and was determined in the buffer control section 19, and is outputted, It consists of the electric-wave transceiver sections 12 which transmit the modulating signal which the hierarchy modulation circuit 15 which carries out the hierarchy modulation of the data outputted from the transmission buffer 18, and the hierarchy modulation circuit 15 output.

[0037] A transmission buffer 18 has the same output as the number of hierarchies of the hierarchy modulation technique to apply, and it outputs it to the hierarchy modulation circuit 15 so that it may become irregular on the hierarchy of the transmission quality determined in the buffer control section 19 sequentially from the data previously inputted among the data in a buffer.

[0038] Although drawing 4 is the important section block block diagram of the hierarchy modulation circuit 15, the hierarchy modulation circuit 15 consists of a mapping circuit 31 and a quadrature modulation machine 32, as shown in drawing 4 .

[0039] Drawing 5 is the important section block block diagram of the wireless terminal of this invention example. The hierarchy demodulator circuit 24 which restores to the signal which the electric-wave transceiver section 22 which receives the electric wave to which the base transceiver station transmitted the wireless terminal, and the electric-wave transceiver section 22 received, The receive buffer 26 which carries out the temporary storage of the data destination information and data to which it restored, and outputs only the data addressed to a self-wireless terminal based on data destination information, The temporary storage of the transmit data is carried out, and it consists of the electric-wave transceiver sections 22 which transmit the modulating signal which the transmission buffer 28 which gives and outputs transmitting agency terminal information to transmit data, the modulation circuit 25 which modulates the data outputted from the transmission buffer 28, and a modulation circuit 25 output.

[0040] The addressing to base transceiver station transmitting former terminal information given to data by the transmission buffer 28 is the information when there is information on the communication link quality which the information which carries out a wireless terminal a ** exception in a base transceiver station, and a wireless terminal require.

[0041] Although drawing 6 is the important section block block diagram of the hierarchy demodulator circuit 24, the hierarchy demodulator circuit 24 consists of a rectangular demodulator 33 and a distinction circuit 34, as shown in drawing 6 .

[0042] Drawing 7 is a flow chart which shows the data transmission procedure of this invention example. With reference to drawing 1 - drawing 7 , the data transmission procedure of this invention example is explained. In a base transceiver station, the receiving level test section 13 measures signal level, whenever the electric-wave transceiver section 12 receives the signal from a wireless terminal, and it outputs this to the terminal information storage section 16. A demodulator circuit 17 restores to the received signal, takes out the transmitting agency terminal information included in this, and outputs this to the terminal information storage section 16. The terminal information storage section 16 has updated the newest receiving level and terminal information for every wireless terminal (S1-S5).

[0043] A transmission buffer 18 is accumulated temporarily in response to the data transmitted to a wireless terminal from a base transceiver station, and outputs this to the hierarchy modulation circuit 15. However, the output to the hierarchy modulation circuit 15 shall be based on the instruction of the buffer control section 19.

[0044] The buffer control section 19 orders a transmission buffer 18 to **** the wireless terminal of the destination of the data outputted to the hierarchy modulation circuit 15, to opt for data-hierarchy-ization to output and to output in the hierarchy modulation circuit 15 according to the hierarchization based on the terminal information accumulated in the terminal

information storage section 16.
[0045] Here, the primary method of hierarchization is hierarchization of assigning the hierarchy of the high signal of quality sequentially from the data of addressing to a wireless terminal with small receiving level using the receiving level of the newest signal as terminal information. Generally, the wireless terminal with a small received signal level is located in a point distant from a base transceiver station, and a large wireless terminal is located in the point near a base transceiver station. Receiving level is small, and by making high resistance [as opposed to allocation and a noise for the data to the wireless terminal generally located in a point distant from a base transceiver station], and transmitting it to the signal of high quality, even if the transmission line of the wireless terminal and base transceiver station is somewhat crude, the transmitting success probability can be made high. Moreover, since the data to the wireless terminal generally located near the base transceiver station have the comparatively good transmission line between the wireless terminal and base transceiver station, even if it assigns and transmits to the signal of to some extent low quality, the probability for the transmitting success probability to fall is small [receiving level is large, and].
[0046] Moreover, the second approach of hierarchization is hierarchization of managing the information on the communication link quality which a wireless terminal requires in a base transceiver station when the communication link quality demanded for every wireless terminal differs, as it was called voice, an image, and data, and assigning the hierarchy of the high signal of quality in order of the height of the quality to demand, using this as wireless terminal information.
[0047] The hierarchy modulation circuit 15 is a configuration shown in drawing 4 , using the data outputted from the transmission buffer 18, carries out hierarchization mapping on the Gauss-Argand plane which consists of I and a Q-axis in the mapping circuit 31, and carries out quadrature modulation of the signal outputted from the mapping circuit 31 with the quadrature modulation vessel 32.
[0048] After frequency conversion of the signal outputted from the hierarchy modulation circuit 15 is carried out to a transmit-frequencies band in the electric-wave transceiver section 12, it is transmitted to the wireless terminal in the communication link zone of a base transceiver station as an electric wave from an antenna 11 (S6 - S9).
[0049] In a wireless terminal, an antenna 21 receives the electric wave from a base transceiver station, the signal of a necessary frequency band is extracted in the electric-wave transceiver section 22, and it outputs to the hierarchy demodulator circuit 24.
[0050] The hierarchy demodulator circuit 24 is a configuration shown in drawing 6 , it restores to the signal inputted with the rectangular demodulator 33, restores to the data by which input this recovery signal into the distinction circuit 34, and hierarchize, and multiplex is carried out, and outputs them to a receive buffer 26.
[0051] A receive buffer 26 stores temporarily the data to which it restored, and outputs data with the instruction of the buffer control section 27. The buffer control section 27 recognizes the wireless terminal of the destination of the data stored in the receive buffer 26, and orders a receive buffer 26 to output only the data of addressing in the end of a local (S10-S13). Transmission of the data from a base transceiver station to a wireless terminal is made as mentioned above.
[0052]
[Effect of the Invention] [as explained above, when transmitting data to two or more wireless terminals by the TDMA method from one base transceiver station according to this invention] The problem that only the data of only one addressing to a wireless terminal have been conventionally transmitted to coincidence is solved. It makes it possible to transmit to two or more terminals by one slot at coincidence by assigning and hierarchizing the data of two or more addressing to a wireless terminal in the bit from which a modulation symbol differs using a hierarchy **** method, and superimposing and transmitting by the signal by which quality differs.

[0053] According to this invention, moreover, by hierarchizing transmit data and transmitting to a wireless terminal based on the information on the communication link quality which the receiving

level and each wireless terminal of the signal transmitted to the last from the accumulated wireless terminal in the base transceiver station require It is effective in making it possible to be able to raise the transmitting success probability of transmit data, and to make it possible to raise the signal-transmission quality of the transit delay and the transmission quality of data, and to raise transmission efficiency. Moreover, it is effective in making it possible to make small capacity of the transmission buffer of the base transceiver station which stores the waiting data for transmission.

[0054] Moreover, according to this invention, there is an advantage that the number of the wireless terminals in which one base transceiver station and communication link are possible can be made to be able to increase, and transmission capacity can be increased according to the above effectiveness.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The important section block block diagram of the base transceiver station of this invention example.
[Drawing 2] Drawing showing signal point arrangement of hierarchy 16QAM.
[Drawing 3] Drawing showing the example of a configuration of the transmission frame used in order to transmit data between the base transceiver station of this invention example, and a wireless terminal.
[Drawing 4] Drawing showing signal point arrangement of hierarchy 16QAM.
[Drawing 5] The important section block block diagram of the wireless terminal of this invention example.
[Drawing 6] The important section block block diagram of a hierarchy demodulator circuit.
[Drawing 7] The flow chart which shows the data transmission procedure of this invention example.
[Drawing 8] Drawing showing an example of a transmission frame which transmits data between the base transceiver station of a TDMA method and a reservation method, and each wireless terminal.
[Description of Notations]
11 21 Antenna
12 22 Electric-wave transceiver section
13 Receiving Level Test Section
14 23 Switch
15 Hierarchy Modulation Circuit
16 Terminal Information Storage Section
17 Demodulator Circuit
18 28 Transmission buffer
19 27 Buffer control section

20 26 Receive buffer
24 Hierarchy Demodulator Circuit
25 Modulation Circuit
31 Mapping Circuit
32 Quadrature Modulation Machine
33 Rectangular Demodulator
34 Distinction Circuit

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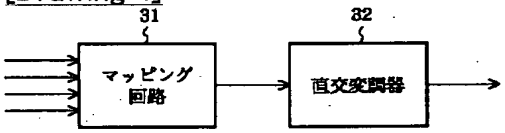
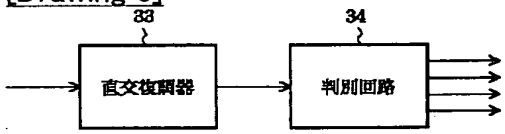
DRAWINGS

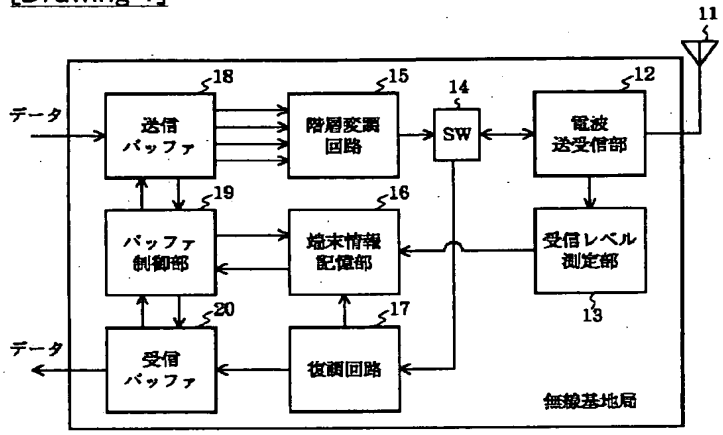
[Drawing 4]



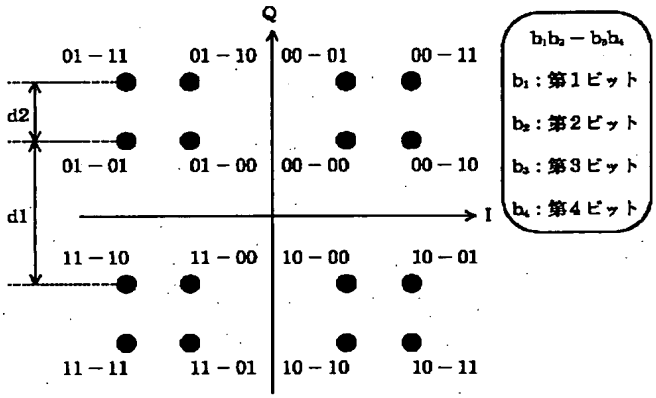
[Drawing 6]



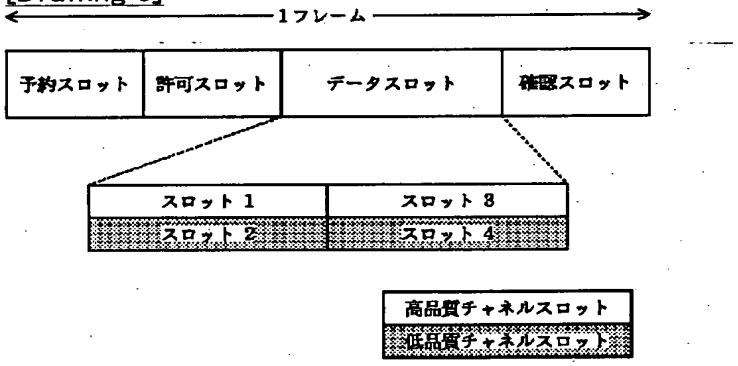
[Drawing 1]



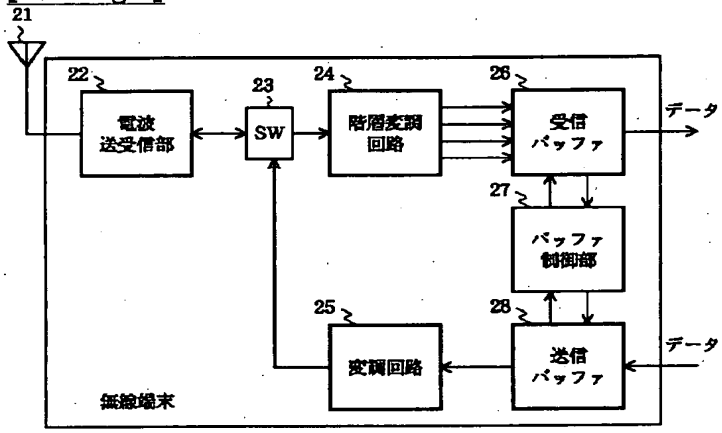
[Drawing 2]



[Drawing 3]



[Drawing 5]



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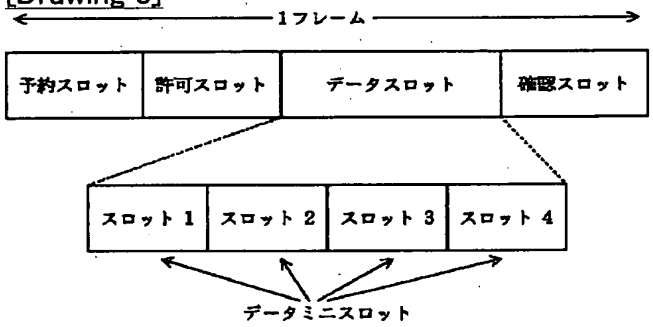

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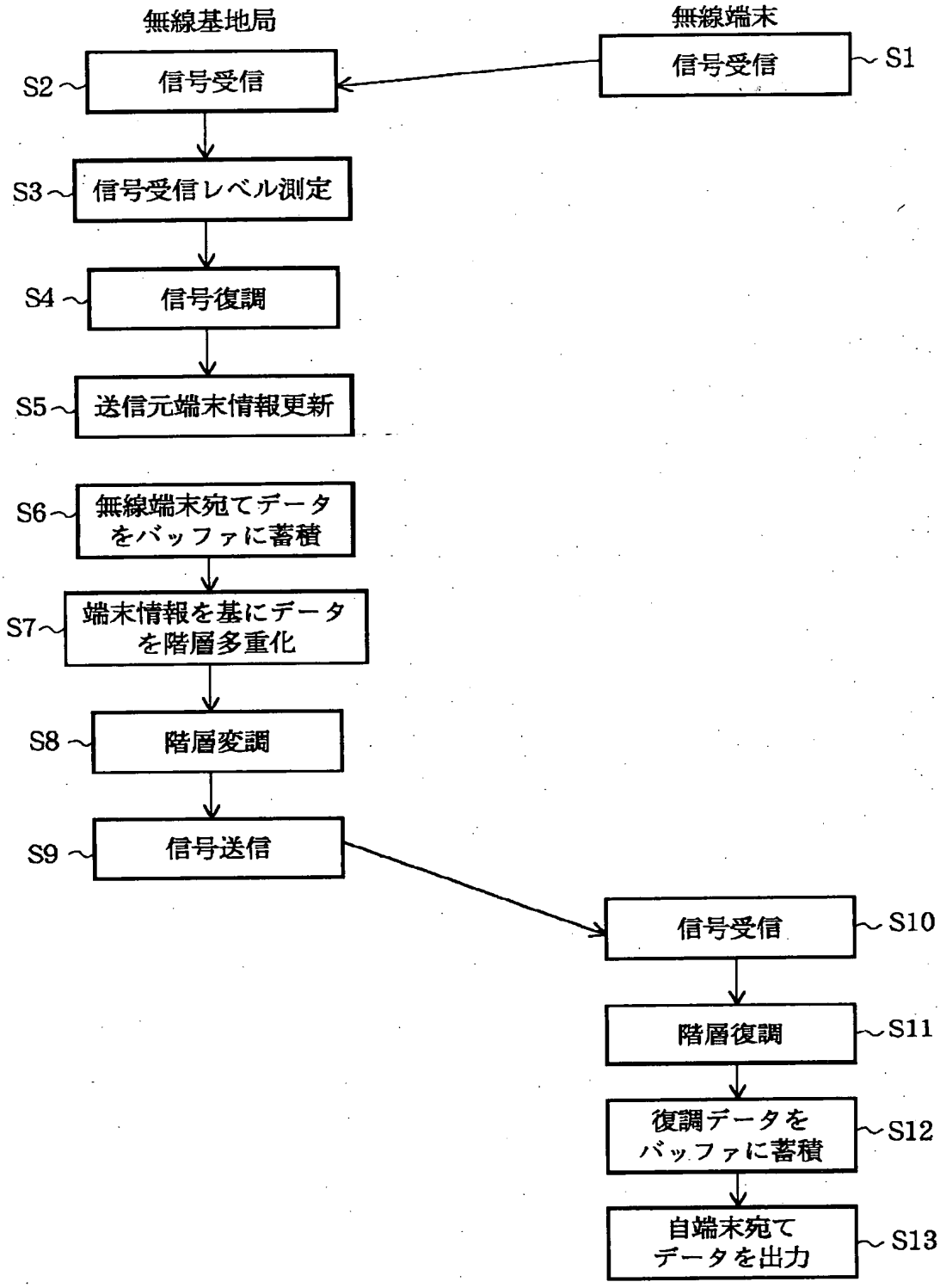

[Translation done.]

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審査請求　未請求　請求項の数７　ＯＬ　（全８頁）

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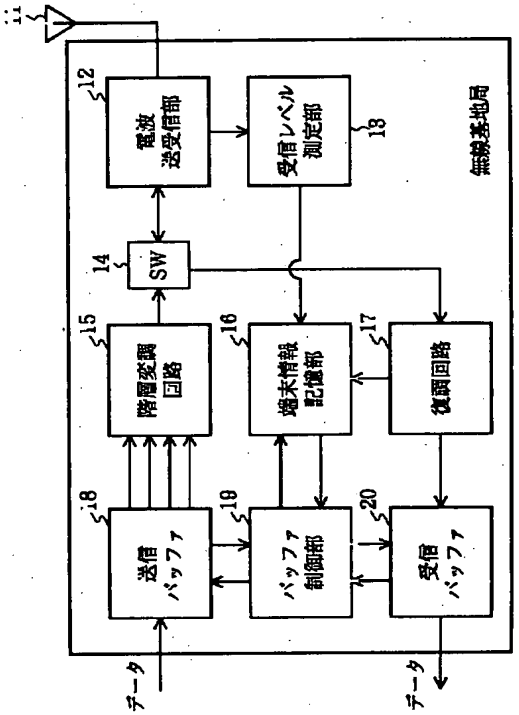
(54)【発明の名称】　無線送信装置および無線通信装置

(57)【要約】
【課題】　一つの無線基地局から複数の無線端末にＴＤＭＡ方式でデータを伝送する場合に、複数の無線端末に同時にデータを送信する。
【解決手段】　階層変調方式を用いて、複数の無線端末宛てのデータを、変調シンボルの異なるビットに割当て階層化することにより、品質の異なる信号で階層多重し伝送する。



【特許請求の範囲】
【請求項１】　複数Ｎの宛先端末に対する個別の通信情報が伝送されるＮ回線の情報を一つの搬送波に同時に多重変調する変調手段を備えた無線送信装置において、
前記変調手段には、複数種類の通信品質の異なる回線が設定され、宛先端末毎にその必要な通信品質に応じて回線を割当てる手段を含むことを特徴とする無線送信装置。
【請求項２】　前記必要な通信品質は、前記宛先端末と自無線送信装置との距離に応じて設定され、前記宛先端末からの受信信号レベルを検出する手段と、この検出する手段により検出された受信信号レベルにしたがって前記距離の遠近を推定する手段とを備えた請求項１記載の無線送信装置。
【請求項３】　前記必要な通信品質は、前記宛先端末の要求にしたがって設定される請求項１記載の無線送信装置。
【請求項４】　前記変調手段は多値ＱＡＭ変調手段を含み、ＩＱ平面上の隣あう信号点間の距離を不均一に配置してその受信側での識別品質に差を設けることにより前記通信品質の異なる回線が設定された請求項１記載の無線送信装置。
【請求項５】　前記多値ＱＡＭ変調手段は、前記ＩＱ平面上の信号点の配置は、前記平面上の象限間の信号間距離ｄ１がその象限内の信号間距離ｄ２より大きく設定され、象限を識別するためのビットを通信品質の高い回線に割当て、象限内で信号点を区別するためのビットを通信品質の低い回線に割当てる手段を含む請求項４記載の無線送信装置。
【請求項６】　前記多値ＱＡＭ変調手段は、１６ＱＡＭ変調手段である請求項５記載の無線送信装置。
【請求項７】　一つの無線基地局と、この無線基地局と相互に通信を行う複数の無線端末とを備え、
前記無線基地局には、請求項１記載の無線送信装置と、前記無線端末からの信号を受信する無線受信装置と、この無線受信装置に受信される前記複数の無線端末からの信号品質にしたがって通信品質別の回線割当を自動的に行う手段とを備えたことを特徴とする無線通信装置。
【発明の詳細な説明】
【０００１】
【発明が属する技術分野】本発明は、一つの無線基地局と複数の端末との間で行う無線通信に利用する。本発明は、一つの室内または一つの建物内など近距離で使用する無線ＬＡＮ（Local Area Network）のために開発された技術であるが、これ以外にも広く利用することができる。本発明は、一つの搬送波に複数の端末に宛てる複数回線の情報を同時に変調する多重変調に関し、特にその多重変調される複数の回線に通信品質のグレード（階層）を設ける技術に関する。情報の重要度に応じて異なる品質で変調することを「階層化して変調する」と画像処理技術の分野で表現することにならい、この明細書では、複数の回線の通信品質にグレード（階層）を設けて一つの搬送波に多重変調することを「階層変調」と表現する。
【０００２】
【従来の技術】従来、複数の無線端末と一つの無線基地局との間で通信を行うシステムの一つとして無線ＬＡＮがある。この無線ＬＡＮシステムにおいて、一つの無線基地局に対し複数の無線端末が通信のために割り当てられたある決まった通信回線を共用し通信を行うために、その通信回線を周波数や時間で分割し、それを一つの無線端末との間の通信に割り当て通信を行う方法をとっている。このとき、周波数を分割する方法は周波数多重アクセス（ＦＤＭＡ）、時間を分割する方法は時間多重アクセス（ＴＤＭＡ）と呼ばれている。
【０００３】以上のようなシステムにおいては、通信回線の使用効率を向上させるために、周波数や時間で分割した通信回線を各無線端末に固定的に割り当てておくのではなく、送信するデータが発生する度に、各送信先無線端末に通信回線を割り当てる方法（予約方式と呼ぶ）がある。これにより、一つの無線基地局は、より多くの無線端末との通信を限られた帯域を用いて効率的に行うことができる。
【０００４】ＴＤＭＡ方式とし、上記に説明した予約方式とした場合において、無線基地局と各無線端末との間でデータを伝送する伝送フレームの一例を図８に示す。予約スロットは、無線端末が無線基地局に対し使用する通信回線を予約するため、または無線基地局が無線端末に対し使用する通信回線を報知するために用いる。許可スロットは、無線基地局が無線端末に送信を許可するために用いる。データスロットは、データを送信するために用いる。確認スロットは、無線基地局、無線端末へデータの送信が正しく行われたかの確認のために用いる。予約、許可、データ、確認の各スロットは、時間的に多重するために、図８のデータミニスロットに示すように、さらに幾つかの複数のミニスロットに分割されている。
【０００５】無線基地局から無線端末へデータパケットを送信する場合、データの送信に先立って、無線基地局は、予約スロットを用いて送信宛先となる無線端末を報知する。その後、無線基地局は、時間で分割されたデータミニスロットを用いて、順に各無線端末宛てのデータパケットを送信する。そして、先にデータ送信を報知されている無線端末は、報知されたデータミニスロットで無線基地局から送信されるデータパケットを受信し、これを正しく受信すると、その確認信号を受信したデータスロットに対応する確認ミニスロットで送信する。
【０００６】
【発明が解決しようとする課題】近年、コンピューターの普及、マルチメディア通信の増加に伴い、無線ＬＡＮ

システムに代表される無線パケット通信システムにおいて、一つの無線基地局と通信可能な無線端末数の増加や、伝送効率の向上、伝送容量の増大が望まれている。

【０００７】前述のように、ＴＤＭＡ方式においては、時間で分割した通信回線を複数の端末で共有して使用するため、図８の伝送フレームの構成から分かるように、一つのスロットで伝送できるデータパケットはたかだか一個であり、一つのスロットで複数の無線端末に同時に送信することはできない。このため、一つの無線基地局と通信を行う無線端末の数が増えると、無線基地局に送信を待つデータパケットの数が増えるため、伝送遅延が大きくなる等の伝送品質の低下を招く、また、パケットの衝突等により伝送効率の低下を招くことにもなる。さらに、無線基地局において送信待ちデータパケットを蓄積しておくバッファの容量を増やさなければならないといった問題も生じる。

【０００８】本発明は、このような背景に行われたものであって、一つの無線基地局から複数の無線端末にＴＤＭＡ方式でデータを伝送する場合に、複数の無線端末に同時にデータを送信することを可能にする無線送信装置および無線通信装置を提供することを目的とする。本発明は、伝送効率の向上、伝送容量の増大を図ることができる無線送信装置および無線通信装置を提供することを目的とする。本発明は、送信データの送信成功確率を高めることができる無線送信装置および無線通信装置を提供することを目的とする。本発明は、信号伝送品質を向上させることができる無線送信装置および無線通信装置を提供することを目的とする。本発明は、送信待ちデータを蓄積する無線基地局の送信バッファの容量を小さくすることができる無線送信装置および無線通信装置を提供することを目的とする。本発明は、一つの無線基地局と通信可能な無線端末の数を増加させることができる無線送信装置および無線通信装置を提供することを目的とする。

【０００９】

【課題を解決するための手段】本発明は、無線基地局から複数の無線端末宛てのデータを伝送するのに、階層変調方式を用いて、複数の無線端末宛てのデータを、変調シンボルの異なるビットに割当て階層化することにより、品質の異なる信号で階層多重し伝送する。これにより、無線基地局は、一つのスロットで複数の無線端末へ同時に送信できる。また、無線基地局は、複数の無線端末宛てのデータを階層化する際に、予め測定してある無線端末から最後に送信された信号の受信レベルをもとに、受信レベルの小さい無線端末宛てのデータから順に品質の高い信号の階層に割り当て伝送する。

【００１０】一般に、受信信号レベルが小さい無線端末は無線基地局から遠い地点に位置し、大きい無線端末は無線基地局に近い地点に位置する。受信レベルが小さく、一般に無線基地局から遠い地点に位置する無線端末に対するデータは、高い品質の信号に割り当てられ、雑音に対する耐性を高くして送信されるため、その無線端末と無線基地局との伝送路が多少粗悪であっても、その送信成功確率を高くすることができる。

【００１１】また、受信レベルが大きく、一般に無線基地局の近くに位置する無線端末へのデータは、比較的その無線端末と無線基地局との間の伝送路が良好であるので、ある程度低い品質の信号に割り当て伝送しても、その送信成功確率は下がることはない。

【００１２】これにより、無線基地局から送信されるデータの送信成功確率が向上し、送信待ちデータを蓄積する無線基地局のバッファの容量を小さくできるだけでなく、データの伝送遅延を小さくでき、かつ伝送効率を向上できる。

【００１３】また、無線端末ごとに要求される通信品質を持つような場合には、その要求品質の高さの順に伝送品質を割り当てることから、データの送信成功確率が向上し、同様に、送信待ちデータを蓄積する無線基地局のバッファの容量を小さくできるだけでなく、データの伝送遅延を小さくでき、かつ伝送効率を向上できる。

【００１４】すなわち、本発明の第一の観点は無線送信装置であって、複数Ｎの宛先端末に対する個別の通信情報が伝送されるＮ回線の情報を一つの搬送波に同時に多重変調する変調手段を備えた無線送信装置である。

【００１５】ここで、本発明の特徴とするところは、前記変調手段には、複数種類の通信品質の異なる回線が設定され、宛先端末毎にその必要な通信品質に応じて回線を割当てる手段を含むところにある。

【００１６】前記必要な通信品質は、前記宛先端末と自無線送信装置との距離に応じて設定され、このとき、前記宛先端末からの受信信号レベルを検出する手段と、この検出する手段により検出された受信信号レベルにしたがって前記距離の遠近を推定する手段とを備えることが望ましい。

【００１７】すなわち、自無線送信装置からの距離が遠い宛先端末については、宛先端末における受信信号レベルが小さくなり、Ｃ／Ｎ（搬送波対雑音比）が小さくなってしまうことが予想されるので、良好な通信品質の回線を割当てることが送信成功確率を向上させるために必要である。これに対し、自無線送信装置からの距離が近い宛先端末については、宛先端末における受信信号レベルが大きく、Ｃ／Ｎも大きいことが予想されるので、通信品質が比較的粗悪な回線を割当てたとしても、送信成功確率が下がることはない。したがって、宛先端末からの受信信号レベルにより、自無線送信装置と宛先端末との距離を推定し、これに応じて必要な通信品質の回線を割当てることがよい。

【００１８】また、前記必要な通信品質は、前記宛先端末の要求にしたがって設定されるようにしてもよい。すなわち、音声や画像、データといったように、宛先端末

が扱うデータ種類に応じてそれぞれ必要な通信品質が異なるので、これを無線送信装置側にて把握し、これに応じて必要な通信品質の回線を割当てるようにしてもよい。

【００１９】前記変調手段は多値ＱＡＭ変調手段を含み、ＩＱ平面上の隣あう信号点間の距離を不均一に配置してその受信側での識別品質に差を設けることにより前記通信品質の異なる回線を設定することができる。

【００２０】前記多値ＱＡＭ変調手段は、前記ＩＱ平面上の信号点の配置は、前記平面上の象限間の信号間距離ｄ１がその象限内の信号間距離ｄ２より大きく設定され、象限を識別するためのビットを通信品質の高い回線に割当て、象限内で信号点を区別するためのビットを通信品質の低い回線に割当てる手段を含むことが望ましい。前記多値ＱＡＭ変調手段は、１６ＱＡＭ変調手段であることができる。これにより、受信側では、通信品質の高い回線と通信品質の低い回線との識別を容易に行うことができる。

【００２１】本発明の第二の観点は無線通信装置であって、一つの無線基地局と、この無線基地局と相互に通信を行う複数の無線端末とを備え、前記無線基地局には、本発明の無線送信装置と、前記無線端末からの信号を受信する無線受信装置と、この無線受信装置に受信される前記複数の無線端末からの信号品質にしたがって通信品質別の回線割当を自動的に行う手段とを備えることを特徴とする。

【００２２】これにより、一つの無線基地局から複数の無線端末にＴＤＭＡ方式でデータを伝送する場合に、複数の無線端末に同時にデータを送信することを可能にする。したがって、伝送効率の向上、伝送容量の増大を図ることができる。また、送信データの送信成功確率を高めることができる。これにより、信号伝送品質を向上させることができる。さらに、送信待ちデータを蓄積する無線基地局の送信バッファの容量を小さくすることができる。また、一つの無線基地局と通信可能な無線端末の数を増加させることができる。

【００２３】本発明の第三の観点は、複数の端末に宛てる個別の情報を論理的に通信品質の異なる回線に割当て一つの搬送波に同時に多重変調する階層変調方法である。

【００２４】

【発明の実施の形態】発明の実施の形態を図１および図２を参照して説明する。図１は本発明実施例の無線基地局の要部ブロック構成図である。図２は階層１６ＱＡＭの信号点配置を示す図である。

【００２５】本発明実施例では、本発明の無線送信装置を無線基地局に適用する。すなわち、図１に示すように、本発明は無線基地局であって、複数Ｎの宛先無線端末に対する個別の通信情報が伝送されるＮ回線の情報を一つの搬送波に同時に多重変調する変調手段である階層変調回路１５を備えた無線基地局である。

【００２６】ここで、本発明の特徴とするところは、階層変調回路１５には、複数種類の通信品質の異なる回線が設定され、宛先無線端末毎にその必要な通信品質に応じて回線を割当てる手段である受信レベル測定部１３、端末情報記憶部１６、バッファ制御部１９を含むところにある。

【００２７】前記必要な通信品質は、前記宛先無線端末と自無線基地局との距離に応じて設定され、前記宛先無線端末からの受信信号レベルを検出する手段である受信レベル測定部１３を備え、端末情報記憶部１６は、受信レベル測定部１３により検出された受信信号レベルにしたがって前記距離の遠近を推定する。あるいは、前記必要な通信品質は、前記宛先無線端末の要求にしたがって設定される。

【００２８】このとき、バッファ制御部１９は、複数の端末からの信号品質にしたがって通信品質別の回線割当を自動的に行う。

【００２９】階層変調回路１５は多値ＱＡＭ変調を行い、ＩＱ平面上の隣あう信号点間の距離を不均一に配置してその受信側での識別品質に差を設けることにより前記通信品質の異なる回線が設定される。

【００３０】図２に示すように、前記ＩＱ平面上の信号点の配置は、前記平面上の象限間の信号間距離ｄ１がその象限内の信号間距離ｄ２より大きく設定され、象限を識別するためのビットを通信品質の高い回線に割当て、象限内で信号点を区別するためのビットを通信品質の低い回線に割当てる。また、前記多値ＱＡＭ変調は、１６ＱＡＭ変調である。

【００３１】

【実施例】本発明実施例を説明する。図３は本発明実施例の無線基地局と無線端末との間でデータを伝送するために用いる伝送フレームの構成例を示す図である。この例は、先に説明した図８に示した従来技術のＴＤＭＡ方式における伝送フレームに対応するものであり、無線基地局から二つの無線端末へ同時に送信することが可能な例を示したものである。二つの無線端末宛てのデータは、階層変調方式により実現する品質の異なる高品質チャネルと低品質チャネルの二つの信号に階層多重して同時に送信される。

【００３２】同時に伝送が可能な無線端末数は、適用する階層変調方式の階層数により決まる。階層変調方式の階層数以上の多重数とする場合は、図３に示すように従来のＴＤＭＡ方式と同様に時間的に分割したスロット構成とする。ここではデータスロットを階層によって二つに分け、さらに、時間的に分割して二つに分け、合計四つのスロット構成としている。

【００３３】次に、階層変調方式について説明する。階層変調方式は、伝送品質の異なる信号を階層多重して伝送することが可能である変調方式である。図４はその一

例である階層１６ＱＡＭの信号点配置を示す図であり、図４の四桁の数字は各信号点に割当てられた４ビットの符号を示している。各数字の上位２ビットは、各信号点が位置する象限に対応しており、下位２ビットは、各象限内の信号点の位置に対応している。

【００３４】一般に信号点間の距離が大きいほど雑音に対する耐性が高い。したがって、上位２ビットについては、各符号間の距離が大きく、雑音に対する耐性が高く、低Ｃ／Ｎでの送信が可能であるが、下位２ビットについては、各符号間の距離が小さく、上位２ビットと比べ高いＣ／Ｎが要求される。そこで、高品質チャネル側の情報を上位２ビットに割り当て、低品質チャネル側の情報を下位２ビットに割り当てることにより、階層数２の階層変調が可能となる。

【００３５】以上のように、階層変調方式は、情報をどのビットに割り当てるかにより、その耐雑音性が異なり、これにより伝送品質の異なる信号を階層多重して伝送することを可能にする変調方式である。なお、信号点配置とビットの割り当て方法を工夫することにより、３以上の階層数を持つようにすることもできる。

【００３６】図１に示すように、無線基地局は、無線端末が送信した信号を受信する電波送受信部１２と、電波送受信部１２が受信した信号の受信レベルを測定する受信レベル測定部１３と、電波送受信部１２が受信した信号から送信元端末情報とデータを復調する復調回路１７と、復調回路１７が復調した送信元端末情報と受信レベル測定部１３が測定した送信端末情報を含む信号の受信レベルとを記憶する端末情報記憶部１６と、端末情報記憶部１６の情報を基に無線端末宛て送信データの伝送品質を決定するバッファ制御部１９と、無線端末宛て送信データを一時格納しバッファ制御部１９で決定された伝送品質により送信データを階層化し出力する送信バッファ１８と、送信バッファ１８から出力されたデータを階層変調する階層変調回路１５と、階層変調回路１５の出力する変調信号を送信する電波送受信部１２から構成されている。

【００３７】送信バッファ１８は、適用する階層変調方式の階層数と同じ出力を持ち、バッファ内のデータのうち先に入力されたデータから順に、バッファ制御部１９で決定された伝送品質の階層で変調されるように階層変調回路１５へ出力する。

【００３８】図４は階層変調回路１５の要部ブロック構成図であるが、階層変調回路１５は、例えば、図４に示すように、マッピング回路３１と、直交変調器３２とから構成される。

【００３９】図５は本発明実施例の無線端末の要部ブロック構成図である。無線端末は、無線基地局が送信した電波を受信する電波送受信部２２、電波送受信部２２が受信した信号を復調する階層復調回路２４と、復調されたデータ宛先情報とデータを一時格納しデータ宛先情報を基に自無線端末宛てのデータだけを出力する受信バッファ２６と、送信データを一時格納し送信元端末情報を送信データに付与し出力する送信バッファ２８と、送信バッファ２８から出力されたデータを変調する変調回路２５と、変調回路２５の出力する変調信号を送信する電波送受信部２２から構成される。

【００４０】送信バッファ２８でデータに付与する無線基地局宛て送信元端末情報は、無線基地局において無線端末を識別する情報や無線端末が要求する通信品質の情報がある場合にはその情報である。

【００４１】図６は階層復調回路２４の要部ブロック構成図であるが、階層復調回路２４は、図６に示すように、直交復調器３３と、判別回路３４から構成される。

【００４２】図７は本発明実施例のデータ伝送手順を示すフローチャートである。図１～図７を参照して本発明実施例のデータ伝送手順について説明する。無線基地局において、受信レベル測定部１３は、無線端末からの信号を電波送受信部１２が受信するたびに信号レベルを測定し、これを端末情報記憶部１６に出力する。復調回路１７は、受信した信号を復調し、これに含まれる送信元端末情報を取り出し、これを端末情報記憶部１６に出力する。端末情報記憶部１６は、無線端末ごとに最新の受信レベルと端末情報を更新している（Ｓ１～Ｓ５）。

【００４３】送信バッファ１８は、無線基地局から無線端末へ送信するデータを受けて一時蓄積し、これを階層変調回路１５に出力する。ただし、階層変調回路１５への出力は、バッファ制御部１９の命令によるものとする。

【００４４】バッファ制御部１９は、階層変調回路１５へ出力するデータの宛先の無線端末を認識し、端末情報記憶部１６に蓄積されている端末情報をもとに、出力するデータの階層化を決定し、その階層化に従って階層変調回路１５に出力するように、送信バッファ１８に命令する。

【００４５】ここで、階層化の第一の方法は、端末情報として最新の信号の受信レベルを用いて、受信レベルの小さい無線端末宛てのデータから順に品質の高い信号の階層に割当てるという階層化である。一般に、受信信号レベルが小さい無線端末は無線基地局から遠い地点に位置し、大きい無線端末は無線基地局に近い地点に位置する。受信レベルが小さく、一般に無線基地局から遠い地点に位置する無線端末に対するデータを高い品質の信号に割当て、雑音に対する耐性を高くして伝送することで、その無線端末と無線基地局との伝送路が多少粗悪であっても、その送信成功確率を高くすることができる。また、受信レベルが大きく、一般に無線基地局の近くに位置する無線端末へのデータは、比較的その無線端末と無線基地局との間の伝送路が良好であるので、ある程度低い品質の信号に割り当て伝送しても、その送信成功確率が下がる確率は小さい。

【００４６】また、階層化の第二の方法は、音声や画像、データといったように、無線端末ごとに要求する通信品質が異なるような場合において、無線端末の要求する通信品質の情報を無線基地局で管理し、これを無線端末情報として用いて、その要求する品質の高さの順に品質の高い信号の階層に割当てるという階層化である。

【００４７】階層変調回路１５は、図４に示す構成であり、送信バッファ１８から出力されたデータを用いて、マッピング回路３１でＩ、Ｑ軸からなる複素平面上に階層化マッピングし、マッピング回路３１から出力された信号を直交変調器３２で直交変調する。

【００４８】階層変調回路１５から出力された信号は、電波送受信部１２で送信周波数帯に周波数変換された後、アンテナ１１から電波として無線基地局の通信ゾーン内の無線端末に送信される（Ｓ６～Ｓ９）。

【００４９】無線端末において、無線基地局からの電波をアンテナ２１で受信し、電波送受信部２２で所要周波数帯域の信号を抽出し、階層復調回路２４に出力する。

【００５０】階層復調回路２４は、図６に示す構成であり、直交復調器３３で入力された信号を復調し、この復調信号を判別回路３４に入力し、階層化し多重されているデータを復調し受信バッファ２６に出力する。

【００５１】受信バッファ２６は、復調されたデータを一時的に蓄積し、バッファ制御部２７の命令により、データを出力する。バッファ制御部２７は、受信バッファ２６に蓄積されているデータの宛先の無線端末を認識し、自端末宛てのデータだけを出力するように受信バッファ２６に命令する（Ｓ１０～Ｓ１３）。以上のように無線基地局から無線端末へのデータの伝送がなされる。

【００５２】

【発明の効果】以上説明したように、本発明によれば、一つの無線基地局から複数の無線端末にＴＤＭＡ方式でデータを伝送する場合において、従来は同時にただ一つの無線端末宛てのデータしか送信できなかったという問題を解決し、階層変網方式を用いて、複数の無線端末宛てのデータを、変調シンボルの異なるビットに割り当てて階層化し、品質の異なる信号で重畳し伝送することにより、一つのスロットで複数の端末へ同時に伝送することを可能にする。

【００５３】また、本発明によれば、無線基地局において、蓄積しておいた無線端末から最後に送信された信号の受信レベルや、各無線端末が要求する通信品質の情報をもとに、送信データの階層化を行い無線端末に送信することにより、送信データの送信成功確率を高めることができ、データの伝送遅延や伝送品質といった信号伝送品質を向上させることを可能にし、かつ伝送効率を向上させることを可能にするという効果がある。また、送信待ちデータを蓄積する無線基地局の送信バッファの容量を小さくすることを可能にするという効果がある。

【００５４】また、本発明によれば、上述のような効果により、一つの無線基地局と通信可能な無線端末の数を増加させることができ、また伝送容量を増大させることができるという利点がある。

【図面の簡単な説明】

【図１】本発明実施例の無線基地局の要部ブロック構成図。

【図２】階層１６ＱＡＭの信号点配置を示す図。

【図３】本発明実施例の無線基地局と無線端末との間でデータを伝送するために用いる伝送フレームの構成例を示す図。

【図４】階層１６ＱＡＭの信号点配置を示す図。

【図５】本発明実施例の無線端末の要部ブロック構成図。

【図６】階層復調回路の要部ブロック構成図。

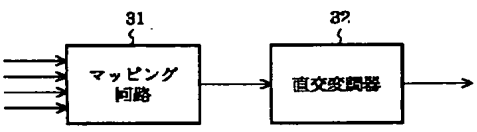
【図７】本発明実施例のデータ伝送手順を示すフローチャート。

【図８】ＴＤＭＡ方式かつ予約方式の無線基地局と各無線端末との間でデータを伝送する伝送フレームの一例を示す図。

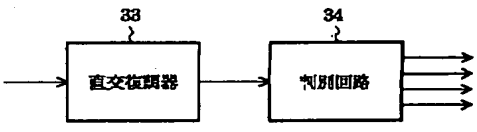
【符号の説明】

１１、２１　アンテナ
１２、２２　電波送受信部
１３　受信レベル測定部
１４、２３　スイッチ
１５　階層変調回路
１６　端末情報記憶部
１７　復調回路
１８、２８　送信バッファ
１９、２７　バッファ制御部
２０、２６　受信バッファ
２４　階層復調回路
２５　変調回路
３１　マッピング回路
３２　直交変調器
３３　直交復調器
３４　判別回路

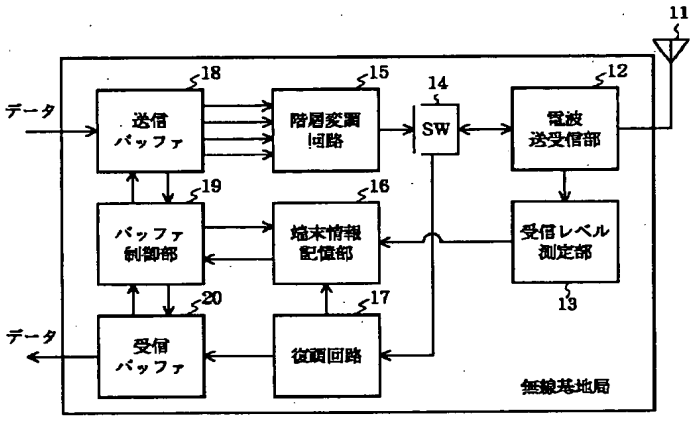
【図４】



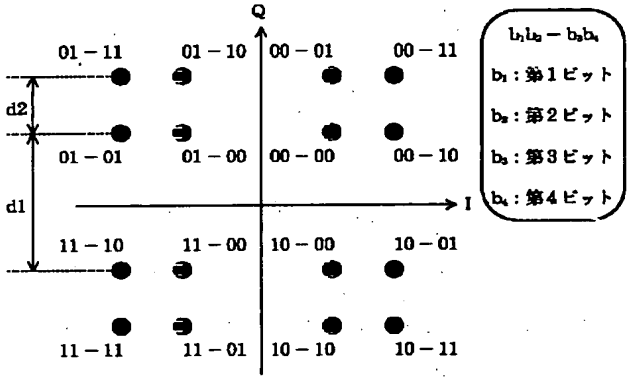
【図６】



【図1】


11
18
15
14
12
データ
送信バッファ
階層変調回路
SW
電波送受信部
19
16
バッファ制御部
端末情報記憶部
受信レベル測定部
13
20
17
データ
受信バッファ
復調回路
無線基地局

【図2】


Q
I
d1
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01－11
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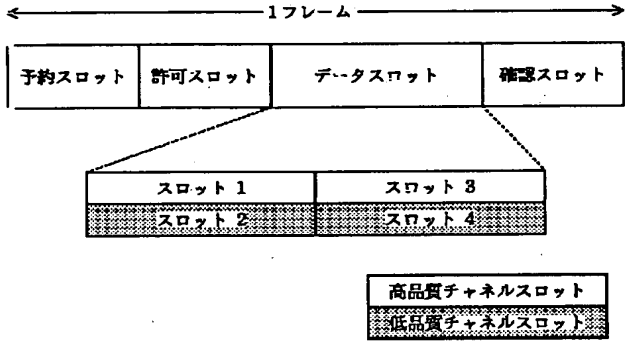
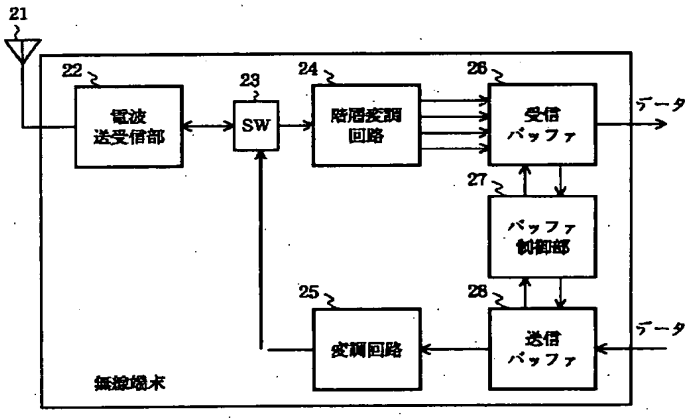
01－01
01－00
00－00
00－10
11－10
11－00
10－00
10－01
11－11
11－01
10－10
10－11
b1b2－b3b4
b1：第1ビット
b2：第2ビット
b3：第3ビット
b4：第4ビット

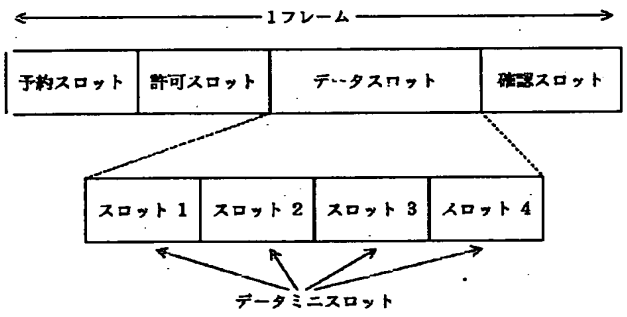
【図3】


1フレーム
予約スロット
許可スロット
データスロット
確認スロット
スロット1
スロット2
スロット3
スロット4
高品質チャネルスロット
低品質チャネルスロット

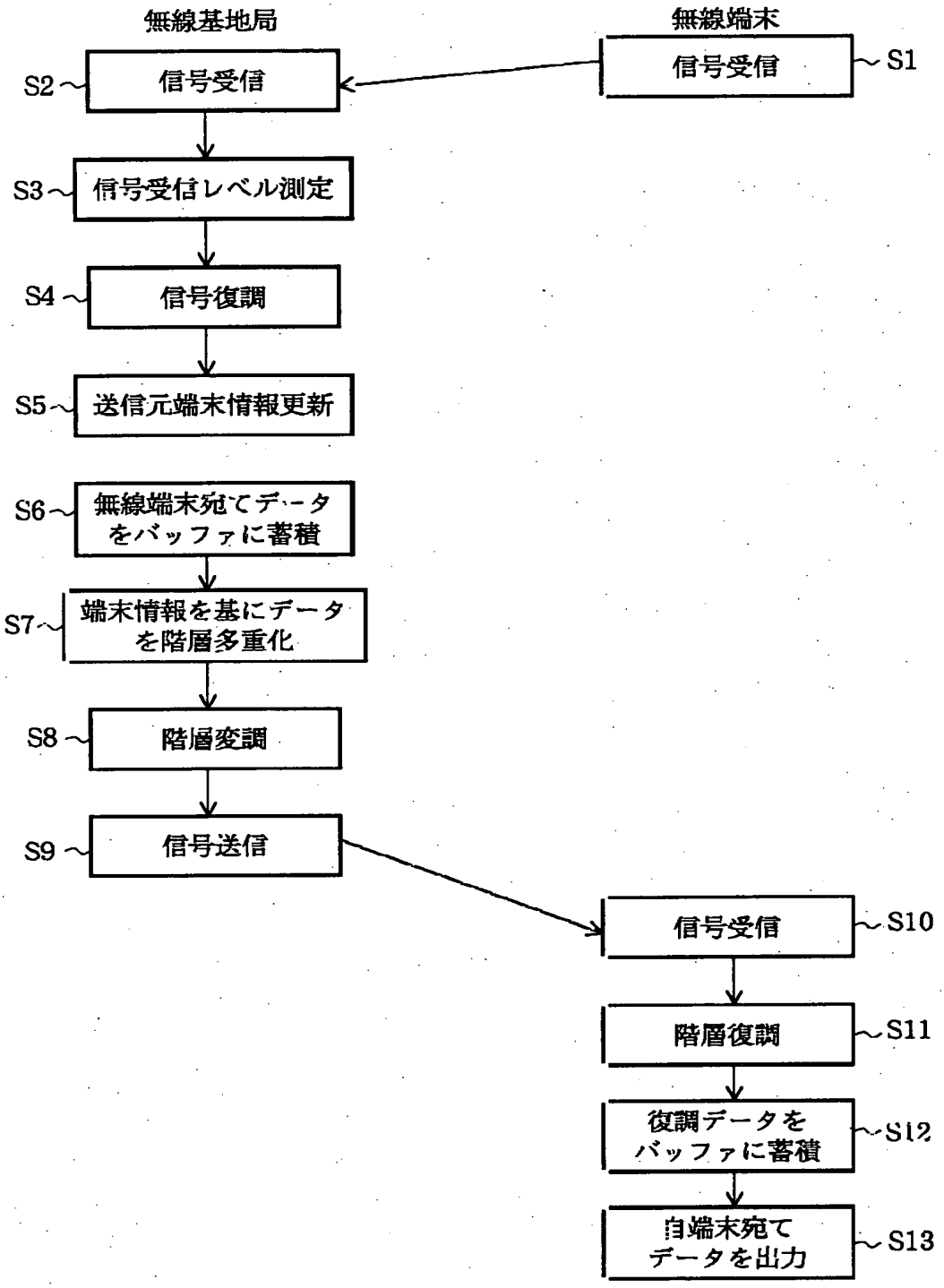
【図5】


21
22
23
24
26
電波送受信部
SW
階層変調回路
受信バッファ
データ
27
バッファ制御部
25
28
変調回路
送信バッファ
データ
無線端末

【図8】


1フレーム
予約スロット
許可スロット
データスロット
確認スロット
スロット1
スロット2
スロット3
スロット4
データミニスロット

【図7】


無線基地局
無線端末
信号受信
S1
S2
信号受信
S3
信号受信レベル測定
S4
信号復調
S5
送信元端末情報更新
S6
無線端末宛てデータをバッファに蓄積
S7
端末情報を基にデータを階層多重化
S8
階層変調
S9
信号送信
信号受信
S10
階層復調
S11
復調データをバッファに蓄積
S12
自端末宛てデータを出力
S13